

CORRESPONDENCE / MEMORANDUM**State of Wisconsin**

DATE: 17 January 2018

TO: Holly Heldstab - Eau Claire

FROM: Pat Oldenburg – Eau Claire

SUBJECT: Water Quality-Based Effluent Limitations for the City of Whitehall (WI-0030970)

This is in response to your request for an evaluation of water quality-based effluent limitations using chs. NR 102, 105, 106, and 217 of the Wisconsin Administrative Code (where applicable), for the City of Whitehall's discharge to the Trempealeau River. The discharge is located in the Middle Trempealeau River Watershed of the Buffalo-Trempealeau River in Trempealeau County.

Based on our review, the following recommendations are made on a chemical-specific basis:

Parameter	Limit Type	Limit and Units	Notes
Flow Rate		MGD	1
BOD ₅ , Total	Monthly Avg	30 mg/L	1
BOD ₅ , Total	Weekly Avg	45 mg/L	1
Suspended Solids, Total	Monthly Avg	60 mg/L	1
pH Field	Daily Max	9.0 su	1
pH Field	Daily Min	6.0 su	1
Copper, Total Recoverable	Daily Max	46 µg/L; 0.58 lbs/day	1
Copper, Total Recoverable	Monthly Avg	46 µg/L	
Copper, Total Recoverable	Weekly Avg	46 µg/L	
Hardness, Total as CaCO ₃		mg/L	1
Phosphorus, Total	6-Month Avg	0.075 mg/L	
Phosphorus, Total	Monthly Avg	0.225 mg/L; 0.75 lbs/day	
Nitrogen, Ammonia (NH ₃ -N) Total	Daily Max - Variable	mg/L	2
Nitrogen, Ammonia (NH ₃ -N) Total	Weekly Avg	34 mg/L	
Nitrogen, Ammonia (NH ₃ -N) Total	Monthly Avg	34 mg/L	
Fecal Coliform	Monthly Geometric Mean	400 #/100 ml	1,3
Fecal Coliform	Weekly Geometric Mean	656 #/100 ml	3
Acute WET		TU _a	4
Chronic WET		TU _c	4

1. Continued from current permit.
2. Daily maximum variable limits:

Effluent pH (s.u.)	NH ₃ -N Limit (mg/L)	Effluent pH (s.u.)	NH ₃ -N Limit (mg/L)
7. < pH ≤ 7.5	>34	8.2 < pH ≤ 8.3	9.4
7.5 < pH ≤ 7.6	34	8.3 < pH ≤ 8.4	7.8
7.6 < pH ≤ 7.7	29	8.4 < pH ≤ 8.5	6.4
7.7 < pH ≤ 7.8	24	8.5 < pH ≤ 8.6	5.3

Effluent pH (s.u.)	NH ₃ -N Limit (mg/L)	Effluent pH (s.u.)	NH ₃ -N Limit (mg/L)
7.8 < pH ≤ 7.9	20	8.6 < pH ≤ 8.7	4.4
7.9 < pH ≤ 8.0	17	8.7 < pH ≤ 8.8	3.7
8.0 < pH ≤ 8.1	14	8.8 < pH ≤ 8.9	3.1
8.1 < pH ≤ 8.2	11	8.9 < pH ≤ 9.0	2.6

3. Limit and monitoring apply May – September.
4. Three tests in permit term (rotating quarters).

Recent updates to chapters NR 106 and 205 of the Wis. Admin. Code require that whenever practicable, effluent limitations be expressed as weekly average and monthly average limitations for continuously discharging publicly owned treatment works.

Fecal Coliforms The new weekly geometric mean fecal coliform limit is recommended based on the approach in NR 106.07(3):

$$\text{Weekly Average Limitation} = (\text{Monthly Average Limitation} \times \text{MF})$$

Where:

MF= Multiplication factor as defined in Table 1

CV= 0.6

n= the number of samples per month required in the permit

NR 106.07 (3) (e) 4. Table 1 — Multiplication Factor

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.6	1	1.31	1.51	1.64	1.95	2.12	2.23	2.3	2.36	2.43

Assuming continuation of weekly fecal monitoring, the recommended weekly geometric mean limitation would be 656#/100 mL.

Copper: Copper remains a water quality concern, and the current copper limits are recommended to be retained in the reissued permit. No changes are recommended to the current water quality-based limitations, however additional weekly and monthly average limitations are recommended. Because daily maximum limitations are the only water quality-based limitations necessary at this facility, and give the fairly large amount of dilution available at the site, it is recommended that the weekly and monthly average limits be set equal to the daily maximum limitation.

Hardness: Hardness monitoring is also recommended to be retained in the current permit due to the relationship between effluent hardness and copper limits. Quarterly monitoring will provide sufficient information.

Phosphorus: The current permit contains a compliance schedule to meet water quality based phosphorus limits of 0.100 mg/L as a 6-month average and 0.300 mg/L as a monthly average. One change is recommended to these limitations. As downstream portions of the receiving water are on Wisconsin's 303(d) list for phosphorus impairments, a mass limit is required per s. NR 217.14. The recommended mass limit is 0.75 lbs/day 6-month average and is based on the corresponding concentration limit and the annual design flow 1.2 MGD.

Ammonia: Changes to NR 106.33 removed the default seasonal 20 mg/L & 40 mg/L cut-offs for ammonia limitations. Data from this facility indicates that the seasonal 20 mg/L cut-off is no longer appropriate at this facility as the 1-day P99 of the May - October data exceeded 20 mg/L. Therefore, it is recommended to adjust the table such that the daily maximum limitations contained in the current permit are in effect throughout the year.

In addition, weekly and monthly average limitations are recommended per NR 106.33(2). Because daily maximum limitations are the only water quality-based limitations necessary at this facility and due to the use of the variable limit table approach, it is recommended that the weekly and monthly average limitations be set equal to the highest daily maximum limit in the daily maximum limit table. The recommended weekly and monthly average limitations are 34 mg/L.

Temperature: The daily maximum temperature limit is 120° F (NR 106.55(2)). There is no reasonable potential for the calculated limitation to be exceeded and no follow-up monitoring is necessary.

TSS: The current TSS limitation is based on NR 210.07(2) and corresponding weekly average limitations are not required.

Whole Effluent Toxicity: Based on Chapter 1.3 of the November 1, 2016 *Whole Effluent Toxicity Program Guidance Document - Revision #11*, three acute and three chronic WET tests are recommended for inclusion in the reissued permit. For additional whole effluent toxicity information please consult the WET check list in SWAMP and the summary table in this attachment.

Finally, the effluent limits for BOD₅, fecal coliforms, and pH are based on NR 102 and 210. Limitations for these substances remain unchanged from the current permit and are protective of the receiving water uses and associated water quality criteria.

If there are any questions or comments, please contact Pat Oldenburg at (715) 831-3262 or via e-mail at Patrick.Oldenburg@wisconsin.gov.

e-cc: Lori Fassbender - Black River Falls
Camille Bruhn - La Crosse
Diane Figiel – WQ/3

Effluent limit calculations for: City of Whitehall
 WPDES Permit #: 0030970
 Permit Drafter: Holly Heldstab
 Basin Engineer: Lori Fassbender - Black River Falls
 WQ Reviewer: Camille Bruhn - La Crosse

Receiving Water Information:

Receiving Water: Trempealeau River
 Watershed: Middle Trempealeau River Watershed
 Basin: Buffalo-Trempealeau River
 County: Trempealeau
 Classification: Warm Water Sport Fish Community, Non-public Water Supply

Flows	7Q10	7Q2	90Q10	Estimated Harmonic Mean	Basin Area (mi ²)
	66	100		147	

% Used For Mixing	=	25	
Hardness	=	105	PPM

Background Metals Data Source:	Pigeon Creek at York	
	Substance	Result
	Cadmium	0.038
	Chromium	0.678
	Copper	1.130
	Lead	0.526
	Mercury	
	Zinc	19.689

Effluent Information:	Daily Average Flow		
Outfall Number	f	(mgd)	(cfs)
001	0	1.2	1.86
Σ	0	1.2	1.86

Effluent Hardness	=	151	PPM
Effluent Dilution due to ZID	=		NA
7Q10:Qe	=	35.5	:1

CALCULATION OF EFFLUENT LIMITATIONS BASED ON ATC (ug/L)

SUBSTANCE	Ref. Hard. or pH	ATC	Daily Effl. Limit	1/5 of Effl. Limit	Mean Effl. Conc.	1- day P99	1-day Max. Conc.
Chlorine		19.03	38.06	7.61			
Arsenic		339.80	679.60	135.92	<1		
Cadmium	151	16.54	33.08	6.62	<3		
Chromium (+3)	151	2526.91	5053.82	1010.76	<6		
Copper	151	22.89	45.78		27.4	111.4	119
Lead	151	159.22	318.44	63.69	<1		
Nickel	151	645.56	1291.12	258.22	<8		
Zinc	151	172.61	345.22	69.04	10		
Chloride (mg/L)		757	1514.00		242.0		291

CALCULATION OF EFFLUENT LIMITATIONS BASED ON CTC (ug/L)

Receiving Water Flow = 16.5 cfs

SUBSTANCE	Ref. Hard. or pH	CTC	Mean Back- ground	Weekly Effl. Limit	1/5 of Effl. Limit	Mean Effl. Conc.	4- day P99	4-day Max. Conc.
Chlorine		7.28		71.97	14.39			
Arsenic		152.20		1504.74	300.95	<1		
Cadmium	105	2.56	0.038	24.97	4.99	<3		
Chromium (+3)	105	137.50	0.678	1353.39	270.68	<6		
Copper	105	10.79	1.130	96.63		27.37	63.0	
Lead	105	29.36	0.526	285.60	57.12	<1		
Nickel	105	54.39		537.73	107.55	<8		
Zinc	105	125.62	19.689	1066.99	213.40	10.0		
Chloride (mg/L)		395		3905.22		242.0		

CALCULATION OF EFFLUENT LIMITATIONS BASED ON HTC (ug/L)

Receiving Water Flow = 36.65 cfs

SUBSTANCE	Ref. Hard. or pH	HTC	Mean Back- ground	Monthly Effl. Limit	1/5 of Effl. Limit	Mean Effl. Conc.	30- day P99	30- day Max. Conc.
Cadmium		370	0.0384	7672	1534	<3		
Chromium (+3)		3.82E+06	0.678	7.92E+07	1.58E+07	<6		
Lead		140	0.5261	2893	579	<1		
Nickel		4.30E+04		8.92E+05	1.78E+05	<8		

CALCULATION OF EFFLUENT LIMITATIONS BASED ON HCC (ug/L)

Receiving Water Flow = 36.65 cfs

SUBSTANCE	Ref. Hard. or pH	HCC	Mean Back- ground	Monthly Effl. Limit	1/5 of Effl. Limit	Mean Effl. Conc.	30- day P99	30- day Max. Conc.
Arsenic		13.3		276	55	<1		

Ammonia Summary

Nov-Apr	NH ₃ -N (mg/L)	May-Oct	NH ₃ -N (mg/L)
1-day P99	22.3	1-day P99	29.4
Max	23	Max	34.8

Date	Hardness (mg/L as CaCO ₃)	Date	Hardness (mg/L as CaCO ₃)	Date	Hardness (mg/L as CaCO ₃)	Date	Hardness (mg/L as CaCO ₃)
07-Nov-12	143	03-Jan-14	150	19-Aug-15	155	02-Nov-16	147
06-Feb-13	189	07-May-14	135	14-Oct-15	160	12-Jan-17	210
10-Apr-13	176	02-Jul-14	155	06-Jan-16	145	21-Jun-17	86
07-Aug-13	112	07-Jan-15	158	06-Apr-16	158	09-Aug-17	176
06-Nov-13	140	01-Apr-15	165	21-Sep-16	140	04-Oct-17	177
Date	Cu (µg/L)	Date	Cu (µg/L)	Date	Cu (µg/L)	Date	Cu (µg/L)
03-Oct-12	8	12-Feb-14	45	24-Jun-15	30	05-Oct-16	24
07-Nov-12	16	05-Mar-14	34	29-Jul-15	16	02-Nov-16	44
05-Dec-12	21	02-Apr-14	34	19-Aug-15	99	14-Dec-16	27
03-Jan-13	20	07-May-14	30	16-Sep-15	14	12-Jan-17	20
06-Feb-13	25	04-Jun-14	15	14-Oct-15	8	28-Feb-17	79
27-Mar-13	27	02-Jul-14	12	04-Nov-15	11	28-Mar-17	70
10-Apr-13	20	06-Aug-14	11	02-Dec-15	15	26-Apr-17	30
29-May-13	13	10-Sep-14	6	06-Jan-16	24	17-May-17	9
19-Jun-13	15	01-Oct-14	5	03-Feb-16	55	21-Jun-17	6
17-Jul-13	16	19-Nov-14	12	09-Mar-16	43	26-Jul-17	3
07-Aug-13	11	03-Dec-14	17	06-Apr-16	28	09-Aug-17	39
25-Sep-13	10	07-Jan-15	29	04-May-16	20	13-Sep-17	52
09-Oct-13	11	04-Feb-15	45	15-Jun-16	15	04-Oct-17	8
06-Nov-13	14	18-Mar-15	53	27-Jul-16	119	01-Nov-17	11
04-Dec-13	20	01-Apr-15	45	24-Aug-16	56		
03-Jan-14	32	06-May-15	29	21-Sep-16	21		
Date	Cl ⁻ (mg/L)						
12-Jun-17	186						
15-Jun-17	232						
19-Jun-17	259						
23-Jun-17	291						

WHOLE EFFLUENT TOXICITY (WET) TESTING CHECKLIST SUMMARY				
	Acute		Chronic	
IWC	Not Applicable for Acute		Instream Waste Concentration:	10
			(< 35% = 0 pts; 36 - 65% = 10 pts; >65% = 15 pts)	
			Total Points:	0
Historical	# detects used to calculate RP:	0	# detects used to calculate RP:	1
Data	# tests failed:	0	# tests failed:	0
	Acute RP:	0	Chronic RP:	0.6
	a limit is required if >1.0		a limit is required if >1.0	
	Total Points:	0	Total Points:	5
Effluent	Points assessed for effluent variability, permit violations and WWTP operations		Same as Acute	
Variability				
	Total Points:	10	Total Points:	10
Stream	Points assessed due to receiving water classification		Same as Acute	
Classification				
	Total Points:	5	Total Points:	5
Chemical	Acute QBEL required:	1	Chronic QBEL required:	0
Specific	Substances detected without QBEL:	3	Substances detected without QBEL:	4
Data	Additional compounds of concern:	0	Additional compounds of concern:	0
	Total Points:	8	Total Points:	3
Additives	# Biocide(s):	0	Same as Acute	
	# Water Quality Conditioners:	1		
	SorbX-100 or other novel chemicals:	N		
	Total Points:	1	Total Points:	1
Discharge	Number of industrial contributors/class of industry:	3	Same as Acute	
Category	Total Points:	7	Total Points:	7
Wastewater	Points assessed due to type of wastewater treatment present		Same as Acute	
Treatment				
	Total Points:	0	Total Points:	0
Downstream	Points assessed due to ecological impacts solely or partially due to the discharge		Same as Acute	
Impacts				
	Total Points:	0	Total Points:	0
TOTAL				
POINTS	Acute:	31	Chronic:	31

Facility Type:	Municipal
Secondary values considered and no WET data?	No
Is this facility classified as a Major Municipal Facility?	No
Effluent limits based on a dissolved water quality criterion?	No
Acute frequency based on points:	3 tests in permit term (rotating quarters)
Chronic frequency based on points:	3 tests in permit term (rotating quarters)
Minimum acute frequency due to # failures and RP:	N/A
Minimum chronic frequency due to # failures and RP:	N/A
Chronic Dilution Series:	100% 30% 10% 3% 1%
Recommended Acute Frequency:	3 tests in permit term (rotating quarters)
Recommended Chronic Frequency:	3 tests in permit term (rotating quarters)
Acute limit required?	No
Chronic limit required?	No
Acute Limit TU _a (daily maximum):	1.0
Chronic Limit TU _c (monthly average):	10.0
Acute TRE Recommended?	No
Chronic TRE Recommended?	No

Effluent Summary (01-Dec-16 – 01-Nov-17):

Parameter	Average	Units
BOD ₅ , Total	22.43	mg/L
Copper, Total Recoverable	29.5	ug/L
Fecal Coliform	46.77	#/100 ml
Flow Rate	0.78	MGD
Nitrogen, Ammonia (NH ₃ -N) Total	2.9	mg/L
pH Field	7.59	su
Phosphorus, Total	0.79	mg/L
Suspended Solids, Total	16.78	mg/L

Addendum: Evaluation of Dissolved-Based Metal Limits for Whitehall

Dissolved-based limits may be evaluated for Whitehall pursuant to the 1997 revisions to chs. NR 105 and 106. It should be noted that the permittee has not formally requested the evaluation of dissolved-based limits, which normally triggers the consideration of such according to s. NR 106.06(7)(b). Since this request has not been submitted, the dissolved-based limits shall be provided for informational purposes in this Addendum with an explanation of the additional data which the permittee would need to submit to demonstrate that the dissolved-based recommendations belong in the permit.

Information required for the calculation of dissolved-based limits includes the conversion factors from ss. NR 105.05 (5) (for acute criteria) or NR 105.06 (8) (for chronic criteria). Background data is also required to translate the dissolved criteria into a site specific number (the “translator”) from which a total recoverable limit may be calculated based on the fraction of the discharged metal which would be dissolved in the receiving water. To perform this translation the following background data is required:

$$\text{Translator} = \frac{(M_p * \text{TSS}) + M_d}{M_d} \quad (1)$$

Where:

M_d : Dissolved metals concentration in the receiving water ($\mu\text{g/L}$)

M_p : Particle-bound metals concentration in the receiving water ($\mu\text{g/g}$)

TSS: Total suspended solids concentration in the receiving water (g/L)

Unfortunately there is no data on dissolved or particulate bound copper concentrations from the Trempealeau River. There is data available on the La Crosse River at Sparta, which is in an adjacent basin, such that a probable site-specific translator can be developed. This information is used to estimate the particulate-bound metals concentration (M_p) using the following formula:

$$\text{Particulate bound metal } (\mu\text{g/g}) = \frac{\text{Total recoverable metal } (\mu\text{g/L}) - \text{Filterable metal } (\mu\text{g/L})}{\text{Total suspended solids } (\text{g/L})} \quad (2)$$

Lacrosse River at Sparta Data:

Date	Dissolved Copper ($\mu\text{g/L}$)	Total Recoverable Copper ($\mu\text{g/L}$)	Total Suspended Solids (mg/L)	Particulate Bound Copper ($\mu\text{g/g}$)
18-May-01	0.960	1.61	15.8	41.1
04-Oct-01	0.501	0.913	6.19	66.6
19-Jun-02	0.738	1.33	8.95	66.1
25-Sep-02	1.01	1.08	6.13	11.4
20-May-03	0.234	1.31	9.36	115
09-Oct-03	0.541	0.881	3.33	102
Geometric Mean	0.597	1.16	7.42	53.8

Trempealeau River at Wade Rd. Data:

Date	Total Suspended Solids (mg/L)	Date	Total Suspended Solids (mg/L)
04-Oct-88	10	05-Apr-89	34
06-Sep-88	15	07-Mar-89	6
02-Aug-88	20	08-Feb-89	11
07-Jul-88	16	04-Jan-89	4
05-Jun-89	56	07-Dec-88	6
02-May-89	13	08-Nov-88	6
Geometric Mean			12

Using the geometric mean of dissolved and particle-bound copper data from the La Crosse River at Sparta and the geometric mean of the total suspended solids data from the Trempealeau River and Equation 1 results in a probable translator of 2.08. Multiplying the translator times the conversion factor times the applicable criterion will give an indication of the amount of “relief” potentially available to the recommended permit limits if the dissolved fraction is considered from the available data:

$$\text{Translated Criteria} = \text{NR 105 Criterion} * \text{Conversion Factor} * \text{Translator}$$

$$\text{Copper: } 22.89 \mu\text{g/L} * 0.960 * 2.08 = 45.71 \mu\text{g/L}$$

Effluent limits calculated based on the translated criteria are as follows:

$$\text{Daily Maximum Limit: } 2 * \text{ATC} = 2 * 45.71 = 91.41 \mu\text{g/L}$$

Using the dissolved-based approach for copper limits, the calculated daily maximum limit would be 91 $\mu\text{g/L}$ (rounded to two significant digits). Since this is in excess of the 1-day P99, a limit would not be required using the dissolved based approach.

The permittee needs to collect on-site information to support either the estimated dissolved-based criteria or some alternate criteria. The following monitoring would be recommended at a minimum for copper at or near Whitehall’s outfall, but these recommendations may need to be modified based on input from Regional staff, the permittee, and others if the permittee wishes to pursue the dissolved based limits.

1. Semi-annual monitoring of total suspended solids and both total recoverable and filterable metals in the receiving water would be needed for at least two years. This information would be used to develop a site-specific translator for copper at Whitehall.
2. Whole effluent toxicity testing is suggested as part of the dissolved-based metals limit process. In this case annual acute and chronic whole effluent testing would be recommended.